S47

First Aid for Broken Databases

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Miami Beach, FL October 22-25, 2001

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Contents

How ia a Database Broken?

- Control Information becomes incorrect
  - Free Space
  - RAPs
  - VSAM CIDF and RDF
- A pointer becomes incorrect
  - Physical pointer
  - Logical Pointer
    - Logical Relations
    - Secondary Indices
  - Chain Pointer
- Data becomes incorrect
  - Incorrect updates
    - Application logic
    - Double updates
    - Bad input
    - Mistaken backout

- This presentation concentrates on Full Function pointer problems

The First Aid Kit

- Image Copies
- Logs including Change Accumulations
- IDCAMS EXAMINE (and DIAGNOSE)
- Recovery Utility
- Reorganization Utilities
- Batch Backout Utility
- Pointer Checker
- IMASPZAP
- Application Programs

The Danger Signs

- **MSGDFSNARL**
  - **DFS0931I** Invalid Index Relationship Between Index DBD and indexed DBD
  - **DFS0934I** PSB psb Referenced SEGM seg in DBD dbd. SEGM has invalid Pointers.
  - **DFS0953I** Logical Child in Database xxx has LP Pointer. LP is HISAM.
  - **DFS0954I** Logical Parent in Database xxx has LC POINTER. LC is HISAM.
  - **DFS2441W** SYMB Pointer from LC www in DBD xxx to LP yyy in DBD zzz is Non-unique.
  - **DFS3098A** Partition Boundary

The Danger Signs...

- **ABENDUxxxx**
  - ABENDU0302
  - ABENDU0790
  - ABENDU0803
  - ABENDU0807
  - ABENDU0808
  - ABENDU0811
  - ABENDU0832
  - ABENDU085x
  - ABENDU0860
  - ABENDU0868
  - ABENDU0931
  - ABENDU0959
  - ABENDU0960
  - ABENDU0987

The Key Questions

- 1. What is broken?
- 2. When was it last known to be good?
- 3. When was it known to be broken?
- 4. What happened between 2 and 3?
- 5. When did it break?
- 6 How did it break?
- 7. Why did it break?
- 8. How do we keep it from breaking again?

The First Aid Process

- Assess the Damage
- Assess the Effect of the damage
- Preserve the Evidence
- Recover the Database

Assess the Damage

- Check the messages and abend codes
- Refer to the Messages and Codes manual
- Refer to the Fast Manual
- Check the dump or snap
- Run Pointer Checker

Assess the Effect

- Importance of the data
- Impact on business process
- Availability of work-around
- Likelihood of repetition
- Impact of down time
- Effect on other work
- ??? Recover immediately or wait until later

Preserve the Evidence

- **Save the damaged database**
  - Rename the data sets and save them
  - Make copies of the data sets
  - Do not forget logically related data set
- **Keep the logs**
- **If VSAM, run EXAMINE and save the output**
- **Keep the dump**
- **Keep the output of the Pointer Checker**
- **Save the console log**
- **Start preparing answers to the key questions**

Recover The Database

Pointers in the Prefix

Prefix Without Logical Relationship

- PP only if a lower level segment is a logical parent

or

Logical Child Prefix

- PP, LTF and LTB only present if virtual pairing

or

Pointers in the Prefix...

Logical Parent Prefix

- PP only if a lower level segment is a logical parent
- Counter is used if no LC pointers are generated

or

Control Fields

Free Space Anchor Point

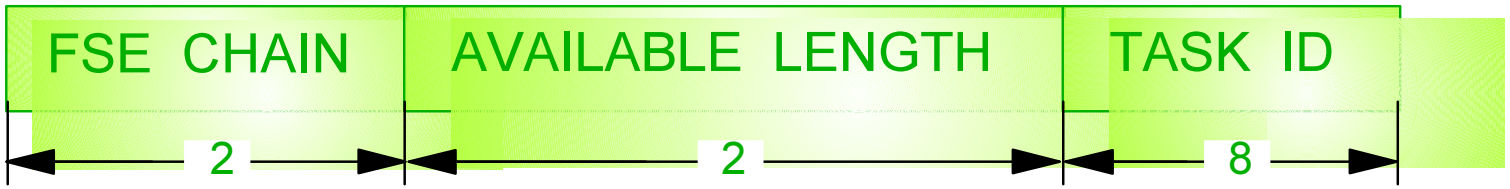
- Two 2-byte fields
  - First the offset from in bytes to first FSE
  - Second is a flag indicating if this block is a bitmap
    0 = this is not a bitmap

Anchor Point Area

- Contains one or more 4-byte Root Anchor Points (RAP)
  - 1 RAP in HIDAM if the root has PTF or HF pointer
  - RMNAME parameter specifies number of RAPs in HDAM

Each RAP contains the address of a root segment or 0s or Fs

Free Space Element



The Bits in the Delete Byte

- **0 - Segment marked for delete**
  - Used in HISAM and index database
- **1 - Database Record marked for delete**
  - Used in HISAM and index database
- **2 - Segment Processed by Delete**
- **3 - Reserved**
- **4 - Prefix and Data are Separated**
- **5 - Segment marked for delete on Physical path (PD)**

The Bits in the Delete Byte....

- **6 - Segment marked for delete on Logical path (LD)**
- **7 - Segment marked for delete on Logical Twin chain**
  - Only set if bits 5 and 6 are set

- FF means that this is the separated data
- 27 is a thoroughly deleted HD segment
  C0 is a thoroughly deleted HISAM or Index segment

Focus on the Damage

- **Look at the Source and the Target of the Bad Pointer**
  - The source is the prefix where the pointer is located
  - The target is the prefix where it is pointing
- **Is the error in the Source or the Target**
  - If in the source, it may be possible to correct it
  - If the Target is bad, it will usually need recovery

Recovery Techniques

Backout

- Ideal when reversing data errors
- May backout pointer errors
  - Usually hits the same problem in trying to process
- Subsequent processing may make this impossible

Forward Recovery

- Only recover to the point at which the error occured
- Will loose some processing
- Can be hard to find a recovery point
  - May have to persuade DBRC to accept your choice
- This will get you a clean database

Reoganization as a Recovery Tool

HD Unload - The Poor Man's Pointer Checker

- Uses unqualified GN calls to read the database
  - Checks all PCF and PTF pointers
  - If it runs clean, the PCF and PTF are good
  - Will not correct bad PCF or PTF pointer
- May use LP pointers during unload
  - If LPCK in the LC is not physically stored
  - If it runs clean, LP pointers are good
  - Will not correct a bad LP pointer

Reorganization as a Recovery Tool...

- **HD Reload - Reconstruction**
  - Rebuilds all physical pointers
    - can correct bad backward pointers
  - Prepares to resolve Logical Pointers
    - DBR will cause unload to save the old LP pointer
    - DBIL will use concatenated keys to resolve relations
- **Prefix Resolution and Update**
  - Rebuild the LP and LT pointers
- **HISAM Reload**
  - Rebuilds the Indices

- If you can reorg your database, it will be good

A Few Last Words

- ★ Don' take heroic measures unless you have to
- ★ Use extreme Care in Repairing Pointers
- ★ It may be better to ZAP a delete byte than a pointer
- ★ Discuss what you are about to do with somebody else
- ★ Activate the Emergency Care System - Dial 911
  - IMS Level 2
  - PSS Group

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